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dent that neither the study of phenomenal nor the mathematical considerations involved, have been exhausted in the papers of the Glasgow Philosophical Society, while the present article does not pretend to do more than to indicate the direction in which enquiry should be pursued.

Remarks upon the Tónkawa Language.

BY ALB. S. GATSCHET.

(*Read before the American Philosophical Society, Nov. 17, 1876.*)

A small body of Texas Indians, the wretched remains of a once powerful tribe, bears the name of *Tónkawas* or *Tónkaways*, and is called *Tónkahuas* by Spanish writers. Through the unfortunate homophony of their name, they were frequently confounded with the Central Texan or coast tribe of the Towakonays, who certainly were congeners of the Wichitas and Wacoos, and led a nomadic life in close community with the Karankáhuas, Arrená-mus and Caris. A bay in the middle part of the Texan Gulf Coast is called Carancáhua Bay up to this day. At the time when Spanish missionaries, along with a number of their Aztec helpmates, had colonized the South of Texas, and disseminated the germs of the Roman Catholic faith among the untutored tribes of aborigines, whom they induced to join in agricultural pursuits in the vicinity of their missions, the Indians were treated with humanity. Then Mexico and all Spanish America freed itself from the domination of the distant mother country; Texas declared itself independent from Mexico, and when after another lapse of time the Texan settlers proclaimed their adhesion to the American Union, a war of extermination commenced against the helpless Indians, which up to our days continues without abatement on the northern border against the roving bands of the Lipans, Comanches and Kiowas.

The Tonkawa tribe, however, whose first mention in American annals occurs at the commencement of this century, seems to have suffered more from internecine wars and feuds with the Comanches, than from white settlers. In 1847 official documents put down the number of their warriors at 155, a decrease of about two-thirds since 1820. The remnants of the tribe, about 35 warriors with their families, are with a number of Lipan-Apaches at present gathered on a reservation in Shackelford County, Northern Texas, seven miles from Fort Griffin. They raise stock, hunt the buffalo, and serve as scouts on the expeditions of the United States troops stationed at Fort Griffin. They are exceedingly filthy in dress and habits, paint their faces in a grotesque manner, and live in canvas tents. Their national legend represents them to be the offspring of the *wolf*; hence this animal is worshipped in their *wolf-dance*, of which Schoolcraft has given a description (in Vol. V).

Two Bavarian gentlemen have lately visited and studied this obscure and half-forgotten tribe, and have favored me with their notations on the na-

tional idiom. One of them, the chemist Oscar Loew, visited in August 1872 that section by order of the "Texas Coal and Copper Mining Association" for metallurgical and mining purposes, and in subsequent years became a very efficient member of Lieut. Geo. M. Wheeler's Surveying Expeditions west of the 100. Meridian. His field-notes on Texas and the Tonkawas have been published in "Petermann's Mittheilungen," Gotha, 1873 (December). The linguistic materials collected by him and Mr. Fr. von Rupprecht were published in full by me in my recent book:

"*Zwölf Sprachen aus dem Südwesten Nordamerikas, Weimar 1876;*" and this article here merely contains the results of a closer investigation, hitherto unpublished, of the Tonkawa words and sentences transmitted to me.

Tonkawa differs absolutely in its radicals from all surrounding American tongues, and the few terms coinciding seem to have been *borrowed* from neighboring idioms. Most syllables *begin and terminate* with consonants, but consonants never preponderate in number so as to obscure the pronunciation of the vocalic elements. The consonants composing T. words are as follows:

Explosives: k, g; t, d; p, b; x; tch.

Spirants: s, sh, h, v, y (in English: *yoke*).

Liquids: n, m, l, r.

f does not occur; d and r are scarce, and g very unfrequent.

Among the vowels i, e, a, o, u (all sounds were given here the *Italian* pronunciation), *a* alone is softened into the "Umlaut" ä (ekkvā and ekkvān *dog*) and forms the diphthongs ai and au. No other diphthongs exist but eu, ei, oi; and those formed with y (ya, ye, yo, yu), if we choose to call them diphthongs. As in most of the Northern idioms of America, vowels frequently form a hiatus: e-e-ion *week*, esamó-i *broom-weed*. Combinations of three consonants frequently occur, but they never sound unharmoniously to our ear, and in fact the Tonkawas seem to be endowed with a remarkable sense for linguistic euphony. They lack the softer palatal dsh, and all the aspirates but χ (or kh): the hard guttural occurring in Welsh, in German ("trachten") and in Spanish (j in *mujer, dejar*); -s at the end of words generally becomes -sh or -tch, and it alternates throughout with sh. A final -n is exceedingly frequent. The mutes often alternate among each other, b with p, g with h, k and χ (and t with tch).

Redoubling the monosyllabic root is a means of grammatical synthesis extensively used for *various* purposes by all languages known; the T., however, seems to employ it almost only for onomatopoeic purposes, as in: tchatchaya *to laugh*, koxoxua *to breathe*, perspire, tchutchux *to be scared*. The nature of the material available does not as yet allow to establish general grammatical laws for the T., but permits a glimpse at its method of compounding words, and gives a few indications of structural import. The system of the object and subject pronouns seems to be rather intricate.

The negative particle *not* consists of two parts, *ka* and *pa*, which are frequently placed one aside of the other, as in Apache, and in Tehua (New-

Mexico). But more frequently only one part of it appears as *k'*, *ka*, *g'*; *b'*, *ba*, *p'*, *pe*—as in: *tcheno to be*, *tchapeno not to be*; *ne-enoχ to know* (?), *nek-enoχ to ignore*, *gin'χenu I do not know* (*g* is here the negative particle); *shai ka tu lel I have no time*; *shaya yétsoχanak on be: I was not in the house*. Where it can be done, the negative particle is incorporated into the stem of the verb as *ba* or *bó*: *hé-el yaχa he eats*, *hé-el yaχabó he does not eat*, *χαχaha I was or went*, *χαχabaha I was not or did not go*. *No!* as a negative answer to an inquiry is *aga*, (*a-ka*)!

Kapa, the two particles combined, or *kapai*, *kapa-i*, evidently has the force of an adjective: “none, nothing”: *shai aχ kapa yeshik I have no water*; *shai aχuenχα kapa yévuesh I have no horse*. It is also pronounced *kopei*, *kopeia*, and in this form occurs as a privative particle in compounds: *shenχōn dress, coat: sankuon-kopei naked*, *kopeia-veika poor, indigent* (the root of *veika* lies in *yé-vuesh to be possessed of*).

The first syllable of the word (*ka*-, *ko*-) probably occurs also in a protracted form in *ka-a sick*.

PREFIXES.

A number of *prefixes* can easily be pointed out in T. verbs and nouns, but to find out the real power and original meaning of these prefixed syllables is a difficult task. *He-* is a frequent prefix in nouns and verbs, and is found also in interrogative pronouns and particles as well as in the demonstrative pronoun of the third person singular; *hé-el, helatla, he, himself*.

he-yatchon eyeglass, cf. *atche to see*.

he-lepuen tree, forest.

he-ntaitchon tooth.

he-nshon blood cf. *ya-tson heart*.

ha-lonkaiχaχ knife, cf. *ya-lona to kill*.

ha-wei, ha-vei large, big, high, tall.

he-ktau-e to sing, chant.

ha-iχo to ride on horseback.

The prefix *ne-* occurs quite often and is used in forming verbs from nouns and nouns from nouns or verbs, as can be inferred from the following examples:

ne-baχka to smoke, from *baχka*, the English word *tobacco*.

ne-shuana to shoot, and *ne-svon-* in the compound *nesvon-pillel round of ammunition*.

ne-vauva to expire, die.

ne-k-enoχ to ignore (lit. “not-well [know]”).

ne-muetan eye (root probably in *metan to flash up*).

ni-muetchχon nose, derived from the preceding.

ni-kamon bone.

ni-steχon ice, from *teχon rock, stone*.

ne-shgashan-oyuk towel.

The most frequent of all the T. prefixes is undoubtedly *ya-*, *ye-*, *yo-*, found in verbs as well as in nouns. In active verbs it seems to fulfill the functions of an object-particle incorporated into the verb, as we see it occur-

ring in many Mexican, Southern and Northern languages; in Aztec f.i. the particles *te-*, *tla-*, *tella-*, are used for this purpose. The nature of this particle is elucidated by the following grammatical juxtapositions :

kala mouth : *ya-cha* to eat.

shaya tchen vantch *I see thee* : *naya ki ye-tchu* thou seest me.

veika possessed-of, having (in : *kopeia-veika indigent*) : *shai yé-vuesh I possess* (a χ uen χ a a horse) : *auvash ye-yachanosh I eat buffalo-meat* (here the particle occurs twice).

In these sentences the particle *ye-*, connected throughout with transitive verbs, has a reference to the direct object, which either precedes or follows the verb. It is found to occur also in the following transitive verbs : *ya-lona* to kill, *yo-choya* to hunt, perhaps also in *eisatuk* to cut, sever, if this term is misspelt for *ye-satuk*.

Some of the following substantive nouns built up with this particle can be distinctly traced to their respective radicals :

yé-tsochan house, originally *tent*, from *tsoch* cloth.

ye-tsoche i-tsan button, from *tsoch* cloth.

e-shauké-huen shirt (probably instead of *ye-tsoké-huen*, from *tsoch* cloth).

ya-cha spur, from *cha* to go (or to make go?).

ye-kochon boot, from *ka* to go, *cha* to go.

ye-keván entrails, guts, from *kevano* wet.

ya-techon stone, rock, cf. *helepuen-tehek* "mountain-forest."

ye-ntan wind.

yo-tchan nail (on fingers and toes).

ya-tson heart.

ye-la chair, seat.

e-bachu-eta woman (instead of *ye-bachu-eta*?).

ya-tch-xenon bread, from *yá-cha* to eat.

The word for *stone, rock* seems to have two forms : *techon*, and *ya-techon*, and the circumstance, that this prefix *ya-,ye-* is generally found in substantives along with the affix *-an, -on, -en*, etc., proves that there exists some connection between the two. Evidently they are the two principal elements used in building up substantives from the monosyllabic roots.

There are many reasons for assuming that *s-, sh-* is a Tonkawa prefix, though it cannot yet be distinctly proved to be such. It occurs in the following pronouns, nouns and verbs :

shaya, shai I, myself.

hetet-shá whereto?

hetet-sho-olok what thing?

shapon to hide, conceal.

shoyana to swim, cf. *esvalan* fish, *aye* to move, or live in water.

soskuono to hear cf. *chaion* (in : *enatch-chaion* ear).

si, se- is also prefixed to the numerals 4, 6, 7, 8, 9, 10.

A few terms of Loew's vocabulary begin with the syllable *ok-*, which I presume to be rather a generic term than a prefix. Perhaps it means "animal" or "quadruped," for it occurs in *okau* skin, *fur-skin*, *okemeillo*

hog, swine, okmek *lion*, and probably stands also in the initial syllable of okopák-χōn *hat* (originally made of skins or fur), in : aχuenχα *horse*, and ukuen *dog*, which is spelt ekkvan by Mr. von Rupprecht. We have here another instance of the curious fact that the horse and the dog are called by Indians with the same root or word-stem and we would possess many more of these instances, if the horse was not so frequently called by the imported Spanish term kaway, kaváyo. The following table gives an enumeration of the terms for *horse* and for *dog* from various tongues :

<i>Isleta</i> (New Mexico)	ganidá, <i>horse</i>	kuyanidá, <i>dog</i> .
<i>Natchez</i>	wvskupser	wvskup (v = a short surd ä.)
<i>Yuma-Tonto</i> (Arizona)	χata	tsata.
<i>Dakota</i>	shunktánka	shúnka.
<i>Payute</i>	pung-gú	pung-gúts.
<i>Sahaptin</i>	kússi	kússikussi.
<i>Wintoon</i> (California)	shuku	kanti-shuku.
<i>Klamath</i>	uátch	uatchága

The last-named term *uátch* simply means "living creature, being," and *uatchága* is its diminutive, from *uá* to *exist, to live, to stay*; applied to our Tonkawa terms composed with *ok-*, this supports the opinion, that *ok* and its compounds have a similar signification of *creature*, or animated *being*.

The Natchez term for *horse* is the augmentative of *wáskup dog*, and as Dr. D. G. Brinton has shown, *wás* is "apparently a generic term for a certain class of animals," and occurs as *wě* in the language of the Uchees or Yuches, which forms a similar series of compounds.

Okemeillo *hog, swine* is really the "beast feeding on the meadow," for hueu-meil means *prairie* or *meadow*.

AFFIXES.

Of a more diversified character than the formative prefixes are the *formative affixes*, that is the syllables *appended* to roots or word-stems, and intended to form derivatives.

We frequently meet f.i. a terminal syllable *-i* in nouns, which is appended almost only to vowels and often coalesces with them into a diphthong :

shaχe-i <i>shadow, shade.</i>	aχaloi <i>ant.</i>
esamo-i <i>broomweed.</i>	kapai <i>nothing.</i>
také-i <i>head.</i>	tei-i <i>liver.</i>
tsélai <i>cloud.</i>	senanda-χas-i <i>copperhead snake.</i>

A second derivational affix *-eta* occurs in the words :

nemuetan *eye.*

beχueta, ebaχueta *woman.*

keta-, kete- *friend, partner* (in : ketepanon *my partner*).

Compare this affix with *eta* to *come* and with the particle *hetetá?* *where?*

A third affix in *-k* (*-ak, -ek, -ik, -ok*) frequently turns up in substantives, adjectives, and other parts of speech :

kalok *beard, mustache*, from kala *mouth*.

tsatsχok *piece, slice* (f.i. of meat).

χak *hair* (on head).

galak *more*.

hitanok *soon, in a short time*.

malek, in : nemuétan malek *eyelid*.

ok-mek *lion*.

oyuk *sack, pocket, bag*, cf. toyo *to put into*.

namek *dry wood*.

makik *yellow 2) gold*.

masslok *white; 2) cattle*.

This -k affix seems to indicate a spot or place and may be equivalent sometimes with "on him, on it, on this." See the locative case below.

The existence of a fourth affix -la, -lan, -lo (o frequently alternates with a, both being probably surd ä), occurring as yet in substantive nouns only, may be inferred from the following words :

anip-hei-la, enopχa-lo *moskito*.

apinki-llin *fly* of various colors, red, etc.

esva-lan *fish*, enko-ó-la *bird*.

haku-läno *valley* "where water is," cf. aχ *water*.

ka-la *mouth*, from ya-χa *to eat*.

kva-lo *stick*, in ne-χo-o-kvalo *gun, rifle* from kue, kve *wood*.

χa-lan *fever and ague*, from ka-a *sick*.

χa-lo *tumbler, drinking-glass*, from χane *to drink*.

massloχ-é-lan *snow*, from masslok *white*.

naχtchon-se-lon *fire-match*, from naχtchon *fire*.

tcho-ó-lan *excrements*.

-la is found also in the personal pronoun helat-la *he, himself*, but this is most likely the particle *ala*, which occurs in many other pronouns and is here apocopated, as the possessive élatan (*his, hers, or its*) demonstrates.

In the numeral series, this particle *ala* is used to form the decades or tens and may be rendered by "times":

sikbaχ *ten*.

sikbaχ ala kita *twenty*, (10 times 2).

sikbaχ ala mitish *thirty*, etc.

In spite of the small number of Tonkawa verbs, of which we are cognizant, some formative endings constantly recur, and we are therefore justified to consider them as derivational affixes forming verbs. One of them is -aua, -ua:

atsoχaua *to cool down*, from atsoχ *cool*.

hektaue *to sing*.

koχoχua *to breathe*, keshkua *to be fond of*.

Another, the sixth of our series, is -ana, -ano, -ono etc., which we discover in the following verbs:

shoyana *to swim*.

metan (instead of metana?) *to flash up* (said of lightning).

ne-shuano *to shoot*.

ke-vano *to be wet; wet, wetted.*

ke-eixena *to be hungry; hungry, famished.*

χane *to drink* (same root as yaχα *to eat*).

shapon (instead of shapona ?) *to hide, to conceal.*

yalona *to kill.*

soskuono *to hear.*

This affix is evidently identical with the verb *eno, enu, tcheno*, which is rendered by *to be, to exist*, but whose primitive signification is that of *going or coming* (ena, aina).

Further verbal formatives can be traced in: -aya, -oya:

tchatchaya *to laugh*, yoχoya *to hunt*, toyo *to put into*.

in: -na, -no:

shokna *to put into*, tchoχno *to sleep*.

This ending probably originated through the syncope of verbs in -ana, -ona, -ono etc.

The most important affix and the ninth in our series is found in all the different categories of nouns (to the exclusion of verbs, probably). This is the affix -n, and its occurrence in participles of the active form of verbs seems to give the key to its real meaning. We have, f. i.:

tchoχnon *physician*, from tchoχno *to sleep, to lie in bed*.

atsoχauan *north wind*, from atsoχaua *to cool down*.

In the derivatives quoted hereafter this ending evidently has *different* functions to fulfill:

he-yatchon *eye glass*, from atche *to see*.

ayon *foot* (from aye *to move?*).

ye-koχon *boot*, from kaχα *to go*.

ye-tsoχan *house, tent*, from tsoχ *cloth, canvas*.

Kānoshan *Mexican*, from Kānosh *Mexico*.

tāχshon *morning*, from tagash *sun*.

But the terminals -an, -en, -in, -on, -un appear also in a considerable number of nouns, whose roots, stems or their meaning are yet a mystery to us (-kin, -χin forms possessive pronouns), and of which we give here a short aperçu:

Adjectives: χaton (also: χatana) *green*.

taχon *warm, hot*.

Substantives: etchnan *day*.

nitχutan *paper*.

hepeian *beads*.

ya-tsoχgan *table-fork*.

natun *hill, mountain*.

tan *tail*.

helepuen *forest, tree*.

bopaχon *fox*.

tróniχon *grass, etc*.

Curiously enough, -en also stands at the end of the higher cardinal numbers, from fifteen upwards:

koskua *five*, koskua-en *fifteen*, sikbaχ-ala-kita kita-en *twenty-two*.

Tree or wood is kve, kue and the *shadow of a tree* is shaχe-i kauvan; hepeian is *beads*, and taχuaz-loman-hepaian is *neck-cloth, neck-kerchief*. From this we may conclude that -n in *kauvan* is the sign of an oblique

case, the *possessive*, and that hepaian simply means "on the neck," or "belonging to the neck," or "of the neck;" then hepai, hepei, or hepaia would be the term for *neck*.

CASES. By a similar analytical process we arrive at the discovery of a few other case-suffixes. Putting together the sentences in which the endings *-ak* and *-ok* are found, we get the following :

shaya yetsoḡanak enubaha *I am not in the house.*

shaya yetsoḡanak on be *I was not in the house.*

hetsho-olok yaḡanoka? *What do you eat? What do you feed on?*

ḡananoke vauva *to die of poison.*

The two first sentences give us a *locative* case in *-ak*, the two latter an *instrumental* case in *-ok*.

The vowel *-u-* occurs at several places, where it seems to be a case-suffix, but is not yet demonstrable as such. If aḡuelpa, for instance, which means *source, spring-water*, is composed of aḡ *water* and he-lepuen *thicket, wood, tree*, (springs are often found near thickets), the inserted *-u-* can hardly be anything else but a case-suffix or a particle of relation; secondly: etat-ḡono *to speak* is composed of eta *to come* and ḡon *a man, man* and therefore signifies in fact "*to come to a man.*" From this may be inferred, that *-t-* and *-o-* (*-u-*) are both particles of relation.

The ending *-sh*, which in verbs is used as a substitute for the pronouns shaya *I* and shaibaḡ *we*, does not seem to be used as a case-suffix, but is found sometimes incorporated in the midst of words, as in naḡtchon-se-lon *fire-match*, ya-tch-ḡenon *bread* (*ya-* prefix, yaḡa *to eat*). As a final sound we find it in words like :

tagash *sun*, from taḡon *warm, hot* (cf. Aztec tonatiuh *sun*, from tona *to be hot*).

nashish *terrapin.*

auvash *buffalo* cf. au *deer.*

apinshos *common fly, house-fly.*

mitish *three.*

se-ketiesh *eight.*

mish-in : mishbaḡ *one.*

nosḡss *young.*

há ash *many.* (See : prefix *sh-*.)

Having discussed the more important features of T. grammar in my German publication, I shall not at present dwell any longer upon this subject, but pass over to the etymological dissection of some compound words and wind up with some ethnographical remarks of general interest.

In forming compounds of two substantives, the Tonkawa language places the depending *after* the governing substantive. *Man, male* means a-akon, in compounds akon; it occupies the first place in akon-kválo, the man of the staff or stick, viz. : *the chief*; it stands second in such terms, as designate objects for personal use, instruments, etc., f.i. okopák-ḡōn *hat* (lit. hat of man). Adjectives not used as predicates seem bound to stand behind the substantive or noun they qualify : aḡ iḡ *bad water*, akon vóḡvan *little, young man, boy.*

From *atche to see* I derive the following terms : etchnan *day*; daylight, shining and seeing being ideas closely connected among themselves; tagash-aitchótak *the east*, lit. : "*sun-where-to see,*" the direction in which

we first see the sun; he-yatchon *eye glass*. If na-ashod *moon* is a term formed after the "*aitchótak*" above, equivalent to "rising," "going-up" (na-aitchót?) and to the Klamath word ka-ukó'ësh *moon* (lit. "*the ascending one*"), it must also be derived from atche *to see*.

kue, tree, wood, stick, gave origin to the following T. words: akon-kvalo "the man of the stick," *the chieftain*; tsoχnetch-le-kvan *soap*, viz., "*stick to wash cloth (tsoχ) with*;" nitχutan-kve *lead-pencil*, viz., "*paper-stick*;" neχoo-kvalo *rifle, gun*, viz., "*shooting-stick*," probably misspelt for nesho-o-kvalo, ne-shuano meaning *to shoot*. Ekvuahen *horn* is probably derived from the same word, as horns frequently bear some resemblance to pieces of wood (instead of e-kvua-en?), and the numeral *six*, si-kualo, recalls the word kvalo, which is reduplicated in *nine*, se-kueskuelo.

texon rock, stone reappears in ya-texon *rock*, ni-s-texon *ice* (water-stone!) and in helepuen-texek *forest, thicket*, literally: wood of the hill. This refers to the circumstance that in the southwest forests are found on elevations only, while the plains remain bare of any woods.

atch earth, land turns up in etcho-χanásh *prairie-dog*, the well-known burrowing rodent of the west, *Spermophilus ludovicianus*, forming extensive underground colonies.

tsoχ cloth, canvas is the etymon of many terms mentioned above, and of: ye-tsoχ-i-tsan *button*, tchoχ-tchapol *blanket*, tsauχ-yetsuχan "*canvas-house, tent*"; apparently also of: niese-tsoχ-kanov *dry, dried*, meaning perhaps a *cloth (tsoχ) dried* by the wind or the fire. Not knowing the original signification of tsoχ, we cannot decide if tchóχno *to sleep, to lie in bed* is derived from it or not.

a-atchoke rich is derived from ha-ash *much, many*, initial *h-* being deciduous in many of the Indian languages.

au deer, auvash buffalo, okau fur-skin, nauval robe, animal-skin are all derived from the same root *au*.

yentan, yundan wind forms yentan-auvei *the south*, lit. south-wind. Auvei, hauei is *strong* and the "*strong-wind*" is the breeze blowing with impetuosity from the coast of the Gulf of Mexico.

keta friend, partner, is identical with the numeral *kita two* and simply means "we two," or "two of us." From *kita two* are formed the numerals si-kuit *four* and se-ketiesh *eight*.

Conclusion.

The confutation of errors, whether they be of importance or not, is always attended with good results, and if we can profit in science and knowledge by such confutation, we should not lose the opportunity. It will not take long to prove with linguistic reasons, that the supposed affinity of the Tonkawas with the Caddoes does not exist.

Words and syllables in Caddo end almost *exclusively in vowels*; words of one syllable are scarce, almost every word has two or more syllables and in dissyllabic words the accent rests on the penultima. Diphthongs occur, but are often recognized with difficulty, owing to the queer method of

transcribing the language; groupings of consonants rarely occur, in T. frequently. *One simple consonant* generally heads the word and syllable; names for colors begin with *a-* or *os-*. The parts of the human frame mostly terminate in *-to*, *-co*, *-no*, *-son*; others begin with *oko-*, *okun-*, which would not be altogether disparate from the T. *akon man*, provided it has the same signification. It is true that the Caddo: *nishe moon*, *axkóto cold*, *winter* bear some external analogy with the T. *na-ashod moon* and *atsox cool*, but there is often a wide difference between resemblance and real affinity. I have given elsewhere a collection of T. words resembling to terms of the surrounding idioms, which might be augmented indefinitely. Only one of the compared languages has yielded a few terms resting probably on real identity, and that is *Aztec*. We find T. (ya-) *xa to eat*, *ka (-la) mouth* and *Aztec (tla-) ka, ka (-matl)*; T. *hauei, auvei great, large*, *Azt. vei, huei*; T. *ax water* and *Azt. atl*. If these coincidences, which Tonkawa has in common with many Sonora languages, are increased by others, we may look out for proofs of old connections between the two ethnical bodies; connections through commerce, expeditions, emigrations or immigrations, not as yet through ethnological affinity. Up to this day a kinship of the Tonkawas with any other American nation or tribe has not been shown, and neither Aztecs, nor Shoshones or Caddoes can claim it on linguistic grounds. A faint resemblance could be traced in two Caddo terms only and phonology as well as grammar disagrees in most particulars from that of the Tonkawas.

NOTE.—Remember well, that the χ used here has *nothing to do* with the English x , but represents the harsh, guttural aspirate *kh* unknown to the English language.

On the Atmospheres of the Sun and Planets.

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There are two cases to be considered; in the first place we may suppose the body surrounded with an atmosphere, to be so hot as to influence, to a considerable extent, the density of the circumambient fluid; and in the second place we may regard the planet as cold like the earth, and as we suppose, Mercury, Venus, and Mars. I shall suppose the atmospheres composed of gases which are subject to the same laws as terrestrial gases.

1. Let us suppose the solar or planetary body to be a sphere of radius r . Also let z be the height of any stratum of the atmosphere above the surface of the planet; ρ the density of that stratum; Z the force of gravity at the height z ; g the force of gravity at the surface of the planet; \triangle the density of the atmosphere at the surface of the planet; p the pressure at the height z ; P at the surface; t_0 the temperature above 32° Fah. at the surface, and t at the height z ; λ the coefficient of expansion; or the fraction expressing